

materially advanced.

The present invention relates to a method of hydrogenation of acetone to isopropanol product.

Acetone is a large-volume industrial product and is prepared in a number of known ways.

One of the known uses of acetone is to prepare isopropanol product, which procedure is generally done by catalytic hydrogenation. A number of publications disclose methods of hydrogenating acetone. However, for many applications, isopropanol must not contain by-products such as isopropyl ether, as well as traces of solvent from the hydrogenation of acetone. This is particularly true in the case where isopropanol is used in medicinal and cosmetic applications. For such applications isopropanol must be obtained with a high degree of purity. Normally, high degrees of purity are only achieved on the industrial scale by the implementation of costly purification steps. For example, when isopropanol is prepared by the introduction of water into propane, sulfur-containing compounds, which are present in the isopropanol product, can prevent use of the isopropanol in the cosmetic and pharmaceutical industries. Removal of these contaminating components is only possible by further treatment of the isopropanol with activated carbon, Al_2O_3 or metals such as copper or nickel. A need, therefore, continues to exist for a method of producing high purity isopropanol by the hydrogenation of acetone.

The discovery of the present invention is an improved industrial-scale process of producing isopropanol by the hydrogenation of acetone, to give the isopropanol product in excellent purity. The key to the present process is that hydrogenation is conducted by liquid-phase hydrogenation in at least two stages. Moreover, as also set forth in the present claims, it is essential that during hydrogenation, the content of water in the acetone to be hydrogenated must be less than or equal to 1% by weight.

Claims 1-12 stand rejected based on 35 U.S.C. §103 as obvious over Horn et al, U.S. Patent No. 5,684,215. This ground of rejection is respectfully traversed.

As noted by Applicants' representative at the interview, the Horn et al reference is relevant to the present invention insofar as it discloses a process of hydrogenating a carbonyl compound such as acetone to give alcohol product. The reference states that, with respect to the "liquid phase" section of the patent in column 4, the reduction reaction of the carbonyl compound can be conducted batch-wise or continuously. Examples 1-5 of the reference show batch-wise processing in autoclaves, whereas Examples 6-8 show continuous hydrogenation, but occurring in only one reactor. There is no teaching or suggestion of conducting the liquid phase hydrogenation of acetone as claimed in the present invention in at least two hydrogenation process stages. Moreover, there is no teaching or suggestion anywhere in the reference that the content of water in the acetone in the hydrogenation reactor has any impact on purity of the alcohol product (isopropanol) produced. Accordingly, Applicants maintain that in fact a *prima facie* case of obviousness over the Horn et al reference has not been established by the Examiner.

However, in order to demonstrate that with increasing water content of the starting acetone product, even in a one-stage process using a circulation reactor of hydrogenating acetone to isopropanol product, increasing quantities of by-products are obtained. As shown in the Table, with water content increasing in the ten examples shown (from 241 to 1099 ppm), the by-product content increases from 191 ppm by-products in Experiment A to 488 ppm by-products in Experiment J. Accordingly, Applicants maintain that the comparative evidence presented showing sensitivity of product purity to water content, which sensitivity the reference does not teach, and further the fact that the reference does not teach or suggest a two-stage process of hydrogenating acetone, distinguishes the present invention over the Horn et al disclosure.

Accordingly, withdrawal of the obviousness ground of rejection is respectfully requested.

Applicants are enclosing an informal, unexecuted Declaration under 37 C.F.R. §1.132 which presents the additional evidence obtained by an inventor for consideration by the Examiner.

Applicants concur with the Fukuhara et al, Sargent and Mertzweiller et al as of only secondary interest to the present invention.

The specification has been amended on page 4 in order to correct a minor error to one of the formulas.

As to the claims, Applicants have amended Claim 1 by incorporating the limitation of Claim 4 therein. Further, support for new Claims 13-15 can be found on page 7 of the specification. Entry of the amendments into the record is respectfully requested.

It is now believed that the application is in proper condition for allowance. Early notice to this effect is earnestly solicited.

Respectfully submitted,

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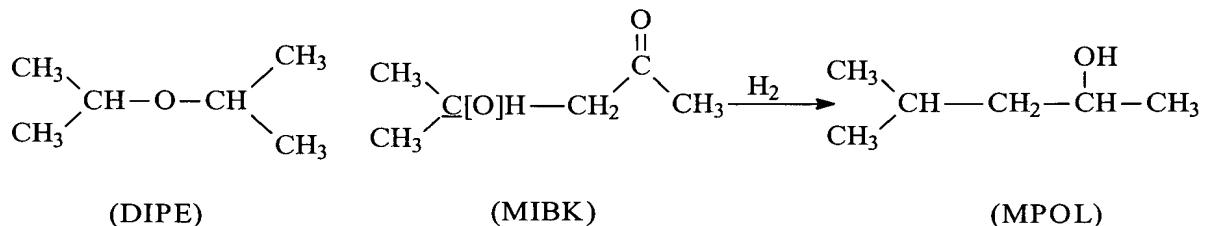
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MARKED-UP COPY OF AMENDMENT

IN THE SPECIFICATION

Page 4, please replace the third formula before the first paragraph of text as follows:



IN THE CLAIMS

Please cancel Claim 4.

Please amend Claims 1 and 5 as follows:

--1. (Amended) A process for the hydrogenation of acetone, which comprises:

conducting the liquid-phase hydrogenation of acetone having a water content of less than or equal to 1.0% by weight in at least two hydrogenation process stages, thereby preparing isopropanol product.

5. (Amended) The process as claimed in Claim [4] 1, wherein the acetone to be hydrogenated has a water content of less than or equal to 0.5% by weight.--

Please add new Claims 13-15.